

should telephone Mr. Arthur L. Liberman, Esq. at (732) 291-9434 so that appropriate arrangements can be made for resolving such issues as expeditiously as possible.

In paragraph 1 on Page 2 of the Office Action of May 14, 2002, the Examiner in charge of the above-identified application indicated that the disclosure is missing a "Brief Description of the Drawings". In response to this objection, applicants have hereinabove added a section to the specification entitled "BRIEF DESCRIPTION OF THE DRAWING" and, in addition, a section entitled "DETAILED DESCRIPTION OF THE DRAWING", taking the verbage therefor from the drawing page 1/1 which immediately follows the claims in the application as filed.

All of the claims under rejection have been replaced by claims 34-60, the language of which is respectfully submitted to overcome the following objections and rejections propounded by the Examiner in charge of the above-identified application:

- The rejection of previously-presented claim 32 under 35 USC §101 as being an improperly-worded process claim;
- The objection to previously-presented claim 29 under 37 CFR §1.75(c) as failing to further limit the subject matter of a previously-presented claim;
- The rejection of previously-presented claims 20-26, 30 and 33 under 35 USC §112(second paragraph).

In paragraphs 6-12 on pages 3,4 and 5 of the Office Action of May 14, the Examiner in charge of the above-identified application rejected all of the claims

under 35 USC §102(b) and 35 USC §103(a) as being anticipated by the Ozaki or Quay references or as being obvious to one having ordinary skill in the art over de Groot (I) in view of Cohn and de Groot (II).

Particularly in view of the newly-presented claims the 35 U.S.C. §102(b) rejections based on the Quay and Ozaki references have been overcome.

The structures of the Ozaki substances are different in kind rather than degree from the structures of the pre-polymers of the claims which are all limited to inclusion of polyester moieties or lactide- $\epsilon$ -caprolactone moieties; which polyester and lactide- $\epsilon$ -caprolactone moieties are missing from the Ozaki structures.

The present claims relate to a biomedical, biocompatible, biodegradable polyurethane. Quay relates to a polyisocyanate prepolymer for use in preparing polyurethane elastomers. Quay does not disclose a biodegradable polyurethane, let alone a biodegradable polyurethane that is of biomedical quality. Indeed, the polyurethane of Quay is based on a *cyclohexane diisocyanate*, which is a toxic compound, as is acknowledged in Quay at column 1, lines 32-33. If the polymer of Quay were biodegradable (which it is not) the release of toxic cyclohexane diisocyanate during degradation in the body would disqualify the polymer of Quay as a biomedical polyurethane. Accordingly, it is respectfully submitted that the subject-matter of the present invention is novel and unobvious over Quay.

With respect to the 35 U.S.C. §103(a) rejections over de Groot (New Biomedical...) in view of Cohn and de Groot (Use of porous...) the following matters are respectfully pointed out to the Examiner in charge of the above-identified application:

- As is the case with Quay, Cohn and de Groot (Use of porous.....) do not discuss biodegradable polyurethanes. The polyurethanes are based on toxic diisocyanates such as cyclohexane diisocyanate. Hence, it can be concluded that these polyurethanes are in fact not biodegradable, or else the release of the toxic monomers would make devices made thereof unsuitable for implantation.
- The examiner states that it would have been obvious to one of ordinary skill in the art to substitute a diol for the diamine of de Groot, because Cohn teaches that these polyurethanes are more easily dissolved or melt processed for shaping medical articles. This is, however, not the reason to substitute the diols of the polymer mentioned in de Groot. As is specifically set forth in the instant specification (page 2, lines 19-29) the choice to use diol-extenders yields polyurethanes with better phase separation. These polyurethanes have also been found to have better mechanical properties. These effects of chain extension of a prepolymer are not discussed in the publications of Cohn and de Groot. Furthermore these publications relate to different kinds of polymers (biodegradable, in the case of applicants' invention vs biostable in the case of the reference disclosures; as well as different kinds of polyurethanes) thus there is no reason for one of ordinary skill in the art to combine

these publications and have a reasonable expectation of success.

- With respect to the non-obviousness of the dependent claims, there is no indication in the publications of de Groot or Cohn to provide a polymer wherein the chain extension has been performed with a diol of the structure XYX (see claim 37) or of the structure YXY or YXYXY (see claim 56), wherein Y is 1,4 butane diisocyanate and X is a diol. It has been found that these structure particularly effectively lower the possibility of transesterification and have improved mechanical properties. The YXY and YKYKY chain extenders have been found to give rise to a particularly well phase separation.
- The subject-matter of claim 36 relates to a specific polyurethane, based on a specific combination of a specific diisocyanate, a polyester and a narrow selection of particularly preferred diols. There is no indication in the cited prior art that would motivate the skilled person to prepare such a polyurethane, let alone is there any suggestion that such a polyurethane would offer all the specific advantages that are relevant for a biomedical polyurethane. Such advantage include good biodegradability, non-toxicity and particularly satisfactory mechanical properties such as modulus, tensile strength and compression modulus.
- With respect to claim 47, it is observed that nowhere in the cited prior art it is suggested to manufacture a biodegradable implant based on a biomedical polyurethane,

having a porosity of 50-99 wt %. As explained *supra*, the material of de Groot (Use of...) is not biodegradable. More specifically, there is no indication in the prior art that an implant as defined in claim 47 would have a satisfactory mechanical properties (such as compression modulus for a meniscus substitute). Besides the biodegradability, the non-toxicity and the ease of manufacturing, additional advantages of such an implant include the good adhesion properties. Thus the subject-matter of claim 47 is not only novel but also non-obvious over the cited prior art.

- Furthermore, nothing in any of the cited prior art suggests or infers the prepolymer of claim 58 (as set forth at page 6, line 13 of the instant specification) or the specific processes of claims 59 and 60, which processes are covered in the Example of the instant specification at pages 8 and 9 thereof.
- With respect to the 35 USC §103(a) rejection propounded by the Examiner in charge of the above-identified application, it is respectfully submitted that the following cases support the position of applicants:
  - *In re Dembiczaik* (CA FC, 4/28/99) 50 USPQ2<sup>d</sup> 1614;
  - *Robotic Vision Systems Inc. vs. View Engineering Inc.* (CA FC, 9/3/99) 51 USPQ2<sup>d</sup> 1948;
  - *Aero Industries Inc. vs. John Donovan Enterprises-Florida Inc.* (D. Ct. S. Ind., 11/22/99) 53 USPQ2<sup>d</sup> 1547; and
  - *Winner International Royalty Corp. vs. Wang* (CA FC, 1/27/00) 53 USPQ2<sup>d</sup> 1580.

Applicants acknowledge receipt of form PTO-948, "NOTICE OF DRAFTSPERSON'S PATENT DRAWING REVIEW" wherein the drawing is objected to under 37 CFR §1.84(p)(3). A formal drawing in full compliance with 37 CFR §1.84 will be submitted on receipt by applicants of a formal notice of allowance, form PTOL-85(b).

The foregoing amendments and arguments are urged to be fully responsive to the Office Action of May 14, 2002, and, in addition, are urged to place this case in condition for allowance.

Accordingly, an early action and allowance of claims 34-60 are respectfully solicited.

Respectfully submitted,

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**CERTIFICATE OF MAILING under 37 C.F.R. 1.8(a)**

I hereby certify that this correspondence is being deposited on **September 4, 2002** with the United States Postal Service as first class mail, with sufficient postage, in an envelope addressed to the Commissioner for Patents, Washington, D.C. 20231.



Signature

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polyurethane had an intrinsic viscosity of 2.00 dL/g and a modulus of 70 MPa.

When polycaprolactone (M=2000) was chain-extended with a BDI.BDO.BDI.BDO.BDI block, a polyurethane of identical composition was obtained. However, in this case transesterification reactions of the chain-extender with the polycaprolactone soft segment were avoided. This resulted into a polymer with an intrinsic viscosity of 1.00 dL/g and a modulus of 105 MPa. The lower viscosity of the polymer can be explained by the lower reactivity of the BDI.BDO.BDI.BDO.BDI block compared to the BDO.BDI.BDO block. However, the modulus has significantly increased. This is a result of the uniform hard segments. Hard segments of uniform size are more crystalline and thus more difficult to disrupt.

The absence of a melting endotherm at 60 oC provides additional evidence that by this method transesterification reactions were avoided.

#### **BRIEF DESCRIPTION OF THE DRAWING**

Figure 1 is a DSC thermogram of three different  $\epsilon$ -caprolactone and L-lactide based polyurethanes.

#### **DETAILED DESCRIPTION OF THE DRAWING**

Referring to Figure 1, the DSC thermogram of three different  $\epsilon$ -caprolactone and L-lactide based polyurethanes, the term 'copolymer' is intended herein to

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mean: "50:50 copolymer of  $\epsilon$ -caprolactone and L-lactide". The graph indicated by reference letter a is for a butane diisocyanate-terminated copolymer prepolymer, chain extended with butanediol. The graph indicated by reference letter b is for the 50:50  $\epsilon$ -caprolactone - L-lactide copolymer chain-extended with butane diisocyanate end-capped butanediol block, The graph indicated by reference letter c is for the 1,4 butane diisocyanate-terminated copolymer prepolymer, chain extended with butanediol end-capped with 1,4 butane diisocyanate block.